Firm: Radiance Technologies, Inc.
Contract Number: NNX11CI45P
Project Title: Energy Conservation and Sustainability Technologies for Propellant Conservation

Identification and Significance of Innovation: (Limit 200 words or 2,000 characters whichever is less)

The proposed innovations are:
(1) a commercial hydrogen sensor (e.g. the H2Scan sensor) to be used for the real time monitoring of hydrogen concentrations during a helium purge.
(2) a bypass configuration with controlled valves to protect the sensor from extreme temperatures and pressures.

The significance of these innovations is:
(1) Improved safety during purges– knowing real time hydrogen concentrations will alert personnel to the dangers associated with high hydrogen concentrations, reduce sampling events and time spent in the danger zone near hydrogen. Also, avoiding the need for pumps, mechanical actuators, or the need to vent the pipe while taking a sample reduces the likelihood of a leak.
(2) Reduce the time required for purges- stop and sniff operations can be minimized, reducing purge times.
(3) Conserve helium - reducing the number of purge events and time of each purge conserves helium supplies.

The sensor can be incorporated into innovative designs that will allow the sensor to operate in a noninvasive fashion in the extreme cryogenic conditions experienced on an engine test stand. The key development for this STTR is not the development of a sensor, but the development of an H2 measurement system designed for operational use.

Technical Objectives and Work Plan: (Limit 200 words or 2,000 characters whichever is less)

The following are the technical objectives for Phase I:

1. Identify sensors' limits of detection for H_2 in He
2. Conduct and evaluate sensor conditioning, verification, and calibration procedures
3. Develop accuracy of measurement techniques
4. Minimization of response time & maximize accuracy
5. Identify the best sensor and installation option

Radiance Technologies, Inc. has divided the project into seven major areas:

- Configure Test Fixtures to Simulate SSC
- Determine Reliability in Cryogenic Conditions.
- Run Pressure Tests at Low Temperatures.
- Test Standoff and Capillary Designs.
- Test Delay Valve That Will Satisfy Requirements
- Determine Optimum Configuration
- Test for Accuracy and Repeatability

Technical Accomplishments: (Limit 200 words or 2,000 characters whichever is less)

- A commercial sensor was identified to be suitable for the continuous measurement of gaseous mixtures of H_2 in He when configured appropriately.
- Tests were conducted that evaluated sensor conditioning, verified the measurements on certified gas mixtures, and demonstrated a calibration procedure.
- The accuracy of the measurements made in each configuration was evaluated using a second sensor mounted directly on the input flow, providing a reference for comparison.
- Through successive adaptations, the response time was minimized and accuracy was continually monitored throughout each test.
- Having minimized the response time while maintaining thermal isolation, an optimum installation configuration was identified.

NASA Application(s): (Limit 100 words or 1,000 characters whichever is less)

There are a number of potential NASA applications:

o He purge of H2
o Thermodynamic condition monitoring
o Liquid/vapor distribution scenarios
o Mass gauging
o Leak Detection

Non-NASA Commercial Application(s): (Limit 200 words or 2,000 characters whichever is less)

There are a number of potential Non-NASA applications:

o He purge of H2
o Thermodynamic condition monitoring
o Liquid/vapor distribution scenarios
o Mass gauging – integrating data throughout a volume
o Leak Detection **–** to avoid contamination, safety, and propellant loss risks
o Insulation integrity determination
o Commercial liquid hydrogen rockets
o Alternative fuel vehicles

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